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Heliographic signalling in *Haploglenius* Burmeister, 1839 (Neuroptera Ascalaphidae)

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ABSTRACT The males of the ascalaphid genus *Haploglenius* are equipped with a movable pronotal flap, covering a white thoracic membrane, whose function remains poorly known. Few recent original observations, conducted on undisturbed specimens in their natural environment, suggest that this structure is part of a complex visual communication system based on intermittently showing the bright, reflecting, thoracic white area on a dark background. This behaviour is probably associated with courtship.

KEY WORDS Animal communication; reflected light; camouflage; Owl-flies.

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On July 23th 2009, during a field survey in Otongachi Forest (Ecuador, Pichincha, La Unión del Toachi) at 850 masl, 0° 18' 49" S, 78° 57' 15" W, the attention of one of the authors (GO) was attracted by a blinking "bright white spot" located into a small hole (about 15 cm deep) among tree roots. The frequency of the signal reminded the flash displays of a firefly, starting whenever the shadow of the observer clouded the midday light. At a closer look, the source was revealed to be an immobile and perfectly hidden adult Ascalaphidae rhythmically lifting up and lowering a flap-like structure on the pronotum with a shining white inner face. The specimen was immediately collected and later identified as a male of *Haploglenius latoreticulatus* van der Weele, [1909] (Fig. 1); it is now preserved in the R.A. Pantaleoni collection.

Furthermore, during the editing of the present work, on March 4th 2014 and again during the day, Giovanni Onore had the opportunity to witness the behaviour in another male ascalaphid in the same locality and just a few hundred meters from the previous observation site (Fig. 3); the owl-fly was displaying inside a thick tuft of Poaceae. On March 23th 2014 a further specimen was observed at Otongachi station, in this occasion attracted to light (Figs. 4, 5). Both specimens have been collected and photographed and, in spite they still require to be appropriately studied, it is possible to identify them as two males belonging to the same species, *H. latoreticulatus*.

The presence of a pronotal flap in South American male owl-flies of subfamily Haplogleniinae has been formerly observed by van der Weele (1909) and Penny (1981), moreover Tjeder (1992) notably reported a similar structure in a still undetermined African genus belonging to subfamily

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Figures 1–3. *Haploglenius latoreticulatus* van der Weele, [1909](Otongachi, Ecuador), views of the prothoracic signaling lobe. Figure 1: habitus of a male specimen with lifted up pronotal flap, showing the bright white marking. Figure 2: detail of the pronotal flap and of the underlying reflecting white membrane. Figure 3: live specimen performing heliographic signals; photos courtesy: A. Barragan.

Ascalaphinae. The only observation about its function in a living specimen was compiled by Eisner & Adams (1975). This striking morphological feature remains poorly investigated, indeed neither an accurate morphological description of the flap (or "dorsocaudal lobe of the pronotum"according to Penny) nor a comparison of the same among different taxa has been published. The structure is certainly present in the males of two closely related South American genera of the tribe Haplogleniini: *Haploglenius* Burmeister, 1839 and *Ascalobyas* Penny, 1981. However, as the flap is often not mentioned in the descriptions of these taxa, it is unclear if it lacks in certain species or if it has been simply omitted.

The flap is a lobe resting on the pronotum when inactive, and rising up when excited (Figs. 2, 3, 4). Its superior/exterior face is homochrome with pronotum, while the inferior/inner face is bright white like the pronotal membrane, with which it is in contact, therefore displaying a rounded white spot when lifted (Figs. 2, 3). The only published account regarding the flap mobility in an alive specimen was done by Thomas Eisner who had a opportunity to observe the response to manipulation of a male of *Haploglenius luteus* (Walker, 1853) attracted to light at the Smithsonian Tropical Research Station, Barro Colorado Island, Canal Zone, on November 17th 1968. Every time the male owl-fly was touched or grabbed, it immediately showed the bright marking. Eisner & Adams (1975) speculated "that this "flashing" behaviour is defensive in function. Whether it merely startles predators or serves also as reinforcement of distastefulness cannot be said, […].

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Figures 4–5. *Haplogenius latoreticulatus* van der Weele, [1909] (Otongachi, Ecuador), live specimen showing the pronotal flap in resting position. Figure 4: dorso-lateral view. Figure 5: lateral view; photos courtesy: M. Kozánek.

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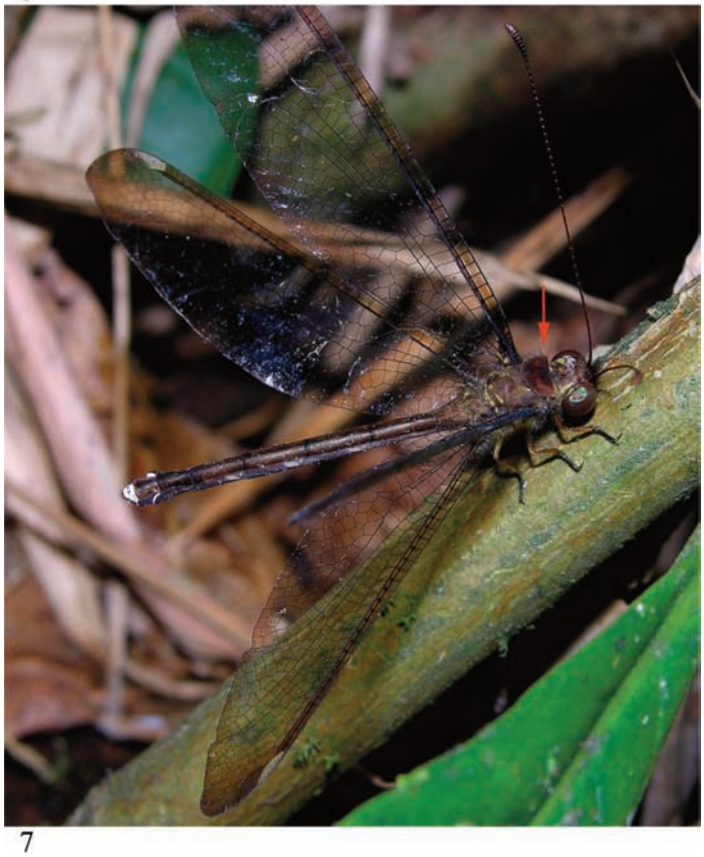

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Figures 6–7. *H. luteus* (Walker, 1853). Figure 6: lateral view of live specimen (Bigal River Biological Reserve, Orellana, Ecuador), the white pronotal membrane is visible under the lobe; photo courtesy: Thierry Garcia. Figure 7: live male specimen from Ecuador with lowered pronotal flap; photo courtesy: Arthur Anker.

The startling function need not be the only, or for that matter primary, function of the flap. Since the device is restricted to one sex, it probably serves also for signalling purposes in courtship."

The observations of Giovanni Onore make clear that the flap and the underlying membrane are comparable to a heliograph as the owl-fly does not emit light but it is able to efficiently signal by reflecting light by means of the white membrane, while the frequency of the signal is regulated by the up-and-down movements of the lobe. Apparently, the blink is associated with courtship and it is very similar to that of fireflies. The illumination may play a decisive role in stimulating the beginning of the behaviour, since it is probably triggered when the light environment ensures the visibility of the signal and at the same time the crypsis of the displayer. Notably, the species equipped with the pronotal lobe are characterized by a cryptic coloration (Figs. 6, 7).

The displaying behaviour observed in male *Haplogenius* is surprising, as there was no clue permitting to presume a similar communication mode. The "heliographic" structure is very peculiar and such a wilful and controlled use of the reflected light is rare if not unique in nature. The greater affinities appear to be with the cromatophores of cephalopods (Mäthger et al., 2009). A main future question to solve about the owl-fly signal is if the flap is able to reflect polarized or ultraviolet light as well known, e. g., in in butterflies of the genus *Heliconius* Kluk, 1780 (Sweeney et al., 2003; Bybee et al. 2012). Similarly, it would be very interesting to understand the role of the displaying system in courtship and its analogies with, e. g., that of fireflies (Lewis & Cratsley, 2008). Unfortunately, the brief period of the day in which the suitable light conditions stimulating the behaviour occur and the elusiveness of these owl-flies make difficult to observe the display in the field.

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REFERENCES

Bybee S. M., Yuan F., Ramstetter M. D., Llorente-Bousquets J., Reed R. D., Osorio D. & Briscoe A. D., 2012. UV photoreceptors and UV-yellow wing pigments in *Heliconius* butterflies allow a color signal to serve both mimicry and intraspecific communication. The American Naturalist, 179: 38–51.

Eisner T. & Adams P. A., 1975. Startle behavior in an ascalaphid (Neuroptera). Psyche, 82: 304–305.

Lewis S. M. & Cratsley C. K., 2008. Flash signal evolution, mate choice, and predation in Fireflies. Annual Review of Entomology, 53: 293–321.

Mäthger L. M., Shashar N. & Hanlon R. T., 2009. Do Cephalopods communicate using polarized light reflection from their skin? The Journal of Experimental Biology, 212: 2133–2140.

Penny N. D., 1981. Neuroptera of the Amazon Basin. Part 3. Ascalaphidae. Acta Amazonica, 11: 605–651.

Sweeney A., Jiggins C. &Johnsen S., 2003. Polarized light as a butterfly mating signal. Nature, 423: 31–32.

Tjeder, B. 1992. The Ascalaphidae of the Afrotropical Region (Neuroptera). 1. External morphology and bionomics of the family Ascalaphidae, and taxonomy of the subfamily Haplogleniinae including the tribes Proctolyrini n. tribe, Melambrotini n. tribe, Campylophlebini n. tribe, Tmesibasini n. tribe, Allocormodini n. tribe, and Ululomyiini n. tribe of Ascalaphidae. Entomologica Scandinavica, Supplement, 41: 3–169.

van der Weele H.W., 1909. Ascalaphiden, monographisch bearbeitet. Collections Zoologiques du Baron Edm. de Sélys Longchamps, Catalogue Systématique et Descriptif, fasc. VIII, 1908, 1–326.